burg, and the Swedish collection generally, and of these we give some notice below. They are exceedingly varied and, in addition to being of great scientific value, are also interesting to persons who have a monetary interest in our fisheries. Mr. Dickson's name is already familiar to the readers of NATURE, in connection with his well-timed support of various Arctic expeditions fitted out from Sweden, and along with his exhibit, or as we may say forming part of it, are two cabinets of preparations of marine animals brought home in the *Vega*, embracing spoils of the sea, obtained by Baron Nordenskjöld in his famous voyage of 1878-80. It is much to be regretted that a catalogue of this exhibit has not been prepared, or at any rate cannot yet be obtained, but a glance at the jars is almost sufficient to show us that there are numerous "finds" of great interest to zoologists. The collections made of worms and crustaceans, of crinoids, sponges, and holothuridæ are exceeding varied, and have been preserved with much care; they evince the activity of all concerned, particularly Dr. Julius Stuxberg, who was "lord of the dredge" in both of Nordenskjöld's Yenisei voyages. The work done with the dredge has already been chronicled in the account given of the voyage of the *Vega*, and it is to be regretted that, from the want of a catalogue, we are unable to do more at present than make this general reference to the collection, which shows us how rich in varied life are the depths of the sea in the high latitudes visited by the professor. A portion of the skeleton of the famous Steller's sea-cow (*Rhytina stelleri*) excites much attention. This animal, there can be little doubt, is now extinct; but when living, it must have been of large proportions, and not unlike a gigantic seal; it would probably be from 25 to 38 feet in length, and weigh 75 cwt., more or less. These remains are of signal importance, proving, as they do, what has been over and over again denied—the existence of a marine mammal of great size and power, herds of which used to browse on the fields of sea-weed.

As may be supposed, "the Swedish Collection" is rich in preparations of the herring: there are over seventy specimens of that fish (*Clupea harengus*), exhibiting its growth from the ova to its most complete stage—that of reproduction. The growth of the sprat (*C. sprattus*) is likewise illustrated in a series of twenty-four preparations, which are of singular interest, so many persons believing that the latter fish is simply a young herring. It is certainly a curious circumstance that the two fish are frequently caught in the same nets, but upon being handled a difference is at once felt, although when taken, both fish are of the same size. The sprat can be at once distinguished from the young herring by means of its strongly serrated abdomen, and when closely examined, it presents several other differences alike of colour and form. A few preparations to show the growth of the pilchard (*C. pilchardus*) are also contained in the Swedish collection. Although the fisheries of Sweden are not of so much value as those of some other countries, great pains have been taken by those in charge of them to teach their fishermen how to make the most of what they have access to—hence the careful preparations of the herring. On the Cattegat an important fishery has been organised, but taken as a whole the total value of the Swedish fisheries is not more than 400,000*l*. per annum. But the Swedish fishermen, not content with the produce of their own waters, venture to the west coast of Norway and the west coast of Jutland, and find it to their interest to do so. Their chief fishing industry when at home, excepting their labours on the coast, consists in capturing the small Baltic herring, which they accomplish by means of seine nets, of good material, and very well made. The industry of herring catching, according to Mr. Oscar Dickson, is of great antiquity in Sweden, and the product of the shoals at particular times, has been of far greater value than the figures we have quoted above serve to indicate. From time to time the fishermen have been cheered by the advent of great bodies of herrings, and at one period, the take in some years, amounted to between two and three million barrels of eight cubic feet each per annum. The catch of herrings last year, the statistics of which have not yet been prepared, is said to have been "positively enormous." It is somewhat remarkable, however, that the figures of the Swedish herring fishery, which were circulated at the Berlin Exhibition of 1880, on the authority of Dr. Lundberg, do not correspond with those for which we are indebted to Mr. Oscar Dickson; according to Lundberg the herring-fisheries of Sweden are of the value of 5,000,000 *marks* annually, but the "millions" of barrels indicated by Mr. Oscar Dickson mean "millions" of *pounds* (not *shillings*) sterling. It is to be hoped this discrepancy of figures will be explained.

Besides these herring exhibits, there is much that is worthy of notice in the Swedish collection. There is, for instance, a display of the eggs of birds which prey on fish. This selection is from the prolific store of Mr. Ramberg, whose collection at Gothenburg is of world-wide celebrity. Some of the eggs which are shown are those of very rare birds. The development and growth of one of our flat fishes (*Rhombus lævis*) is exemplified in all stages of growth, some of which are singular, as, for instance, the changing of the eye in the flounder from one side of its head to the other. We hope Mr. Oscar Dickson's contributions and those from the Gothenburg Museum will be shown in London next year, and that Dr. A. W. Malm will again be in charge of the whole of the Swedish collection, which would require a much larger amount of space for its description than we have at present to bestow.

One of the most interesting of the exhibits shown in the Fisheries Exhibition is Sir John Graham Dalzell's smooth sea-anemone (*Actinia mesembryanthemum*), which is familiarly known as "Granny." It was taken from a rock pool at North Berwick, on the Firth of Forth, so long ago as August, 1828, and was then placed in the glass jar in which it is now exhibited. At that time it was thought it might be seven or eight years old, and its age at present may be over sixty years. During a period of twenty years "Granny" produced 334 young ones. In 1851, after the death of Sir John, who, according to the article "Aquarium," in the "Encyclopædia Britannica," was a keen student of marine animals, several of which could always be seen at his house in a humble kind of aquarium, this anemone was placed in the possession of the late Prof. John Fleming, and was carefully tended by him so long as he lived. Shortly before the death of the Professor, which took place in November, 1857, "Granny" unexpectedly gave birth, during a single night, to 240 living young actiniæ. Dr. James McBain, R.N., who took a warm interest in zoological affairs, was the next custodian of the smooth sea-anemone, which was presented to him by the widow of Prof. Fleming; it remained in his custody until a few days before his death in March, 1879, when he presented it for safe keeping to Mr. John Sadler, curator of the Royal Botanic Gardens in Edinburgh. In the glass jar, along with "Granny" three out of seven young ones are shown, born on February 18 last. As may be supposed, with such an interesting biographical record, Sir John Graham Dalzell's smooth sea-anemone is a decided feature among the "exhibits." Sir John was the author of "Rare and Remarkable Animals of Scotland," as well as numerous other works now forgotten.

NOTES

SIR H. COLE, K.C.B., late director of the South Kensington Museum and Inspector-General of the Science and Art Department, died on Tuesday night at his residence, Philbeach Gardens, Earl's Court. Sir Henry was in his usual health until Monday last, when he visited a photographer's and sat for his portrait. On returning home, he complained of feeling unwell, and gradually became worse. The cause of death is stated to be disease of the heart.

WE have received a most remarkable communication in the form of a pamphlet from the late Professor of Physics and Chemistry at the Royal Military Academy, which, were it not for his high scientific position and extended experience, we should hesitate to allude to. The grievance mostly complained of is the want of discipline existing amongst the cadets, so much so that the instruction in the above-mentioned very important subjects could only be carried on in an imperfect manner detrimental to the service. That such a state of affairs has or does exist in an important public department like the Royal Military Academy is a very serious matter. The pamphlet, for which Prof. Bloxam is answerable, exposes, if correct, a state of things that certainly should not exist in any educational establishment, and more especially not in one of the importance of this school for the future officers of the army. The following, from one of the letters contained in the pamphlet, certainly exhibits, if correct, a very undesirable state of affairs. "During the last ten years, I have pointed out to successive Governors, that the character of the classes was deteriorating, and I have now to state, with profound regret, that the conduct of the majority, when they first come under my instruction, and of a considerable proportion up to the end of their curriculum, is that of boys in an ordinary boarding-school with a very low standard of morals and discipline; so that the position which was formerly held by Professors Faraday and Abel has now become that of an usher, and such services as I am competent to render as a teacher of science are in a great measure lost to the Academy although a knowledge of chemistry and physics has become more than ever necessary to the Scientific Corps."

THE honorary degree of LL.D. has been conferred upon Mr. G. J. Romanes, F.R.S., by the University of Aberdeen.

M. HENRY GIFFARD, the eminent French engineer, the inventor of the injector known by his name, of captive balloons, and of the experiments with directing steam balloons, has died after a protracted illness, at his residence at Paris, at the age of fifty-seven. He was unmarried, and has left his large fortune, amounting to several millions of francs, to the French Government to be devoted to the promotion of scientific research.

AT the Royal Institution the probable arrangements for the Friday evening meetings after Easter are as follows:—April 21: Prof. Dewar, Experimental Researches of Henri Ste. Claire Deville, Hon. M.R.I.; April 28: Prof. Abel, Some Dangerous Properties of Dusts; May 5: Prof. R. Grant, The Proper Motions of the Stars; May 12: A. G. Vernon Harcourt, The Relative Value of Different Modes of Lighting; May 19: Sir Frederick Bramwell; May 26: Sir Henry S. Maine, Sacred Laws of the Hindus; June 2: H. H. Statham, The Intellectual Basis of Music; June 9: Prof. Burdon Sanderson, The Excitability of Plants.

WITH the exception of Mr. Samuelson, M.P., and Mr. Slagg, M.P., the Royal Commissioners on Technical Education, viz., Mr. Woodall, M.P., Professor Roscoe, Mr. P. Magnus, Mr. Swire Smith, and the secretary, will leave England on Friday for a tour of several weeks in Switzerland and Germany, beginning at Alsace. Mr. Woodall, who will return earlier than the other members of the party, proposes also to visit the famous potteries of Saarguemines. In the course of their tour the commissioners will visit a number of works, technical schools, &c., in order to be able to include in their next report the result of their observations as to the influence of scientific and technical education upon industrial pursuits and foreign manufactures.

MR. E. W. WHITE, F.Z.S., of Buenos Ayres, who was present at the inauguration, on March 15, of the Continental Exhibition, held in the outskirts of that city, sends us a short notice of it. The building of wood and zinc, painted of a sombre colour, and a pretty close copy in miniature of that of the Paris Exhibition, covers about eight acres of ground, occupying the site of the Plaza Once. The present Exhibition is the result of the unceasing efforts of the Industrial Society of Buenos Ayres. To foster South American, and especially native, production, and stimulate their industries, were the special objects of the Committee, so that Europe was debarred as an exhibitor, in all but the single item of machinery. This restriction put upon exhibits without the limits of the continent of South America seems to Mr. White a suicidal policy, as it is only by comparison with the superior that the inferior has a chance of improvement. "What immediately strikes the observer on passing through the galleries is the wonderful profusion of native products, especially from the provinces, but the paucity of purely native industries; for although the city and province of Buenos Ayres make a good show in leather work, furniture, and carved woodwork, glass, inks, jewellery, millinery, carriages, typography, lithography, photography, liquors, beers, biscuits, metal castings, mosaic and tilework, &c., such is chiefly due to the intelligent foreign workmen resident in her midst, making use to a very great extent of foreign material; whilst, on the other hand, ores, marbles, wines, cereals, wool, silk, hides, leather, tans, woods, lignite, medicinal herbs, rice, tobacco, sugar, cotton, fruits, manures, dried and potted meats, fossils, &c., of the interior parts of the country astonish and indicate a future wealth which is boundless. Agricultural machinery is well represented, and forms a very interesting feature of the Exhibition; here England maintains her supremacy, owing to the intelligence and activity of her agents. Far otherwise, however, is it in other classes of machinery, such as that adapted to sugar manufacture, in which France, with inferior resources, rules as sole monarch; the fact is the moral of the bundle of faggots is lost upon our countrymen, who are always disunited, always late, and never learn, never forget. The inauguration took place in the midst of great splendour. Dr. Avellaneda, the ex-President of she Republic, and the honorary president of the Exhibition Committee, delivered the inaugural address, which was a brilliant piece of oratory, to which General Roca, the President of the Republic, surrounded by the whole diplomatic corps, foreign and native, replied in a very effective speech, declaring the Exhibition open."

WE are glad to welcome the *New Zealand Journal of Science*, the first number of which for February, has come to hand (Dunedin, Wilkie, and Co.). It seems to have been started in a proper spirit, and we trust it will continue as it has begun, to devote its pages to science in New Zealand, and to form a means of intercommunication between workers in science there. Among the articles in this number are the following:—"What is an Earthquake?" by Prof. F. W. Hutton; "A Visit to the Weka Pass Rock Paintings," by Mr. W. M. Maskell; "On the Preservation of Invertebrata," by Prof. T. J. Parker; "On a Common New Zealand Pycnogonid;" "The New Zealand Micro-Lepidoptera;" with general notes, meetings of societies, and correspondence.

WE have received from Messrs. Trübner and Co. a handsome and richly illustrated quarto, "The Horse in Motion, as shown by Instantaneous Photography, with a Study in Animal Mechanics, founded on Anatomy and the Revelations of the Camera, in which is demonstrated the Theory of Quadrupedal Motion," by J. D. B. Stillman, A.M., M.D. The investigations are executed and published under the auspices of Mr. Leland Stanford, of Palo Alto Farm, California. We hope shortly to notice this work at some length, and meanwhile make the following extract from Mr. Leland Stanford's preface, which shows the exact part taken by each of those concerned in the investigation:—"I have for a long time entertained the opinion that the accepted theory of the relative positions of the feet of horses in rapid motion was erroneous. I also believed that the camera could be utilised to demonstrate that fact, and, by instantaneous pictures, show the actual position of the limbs at each instant of the stride. Under this conviction I employed Mr. Muybridge, a very skilful photographer, to institute a series of experiments to that end. . . . When these experiments were made, it was not contemplated to publish the results; but the facts revealed seemed so important, that I determined to have a careful analysis made of them. For this purpose it was necessary to review the whole subject of the locomotive machinery of the horse. I employed Dr. J. D. B. Stillman, whom I believed to be capable of the undertaking. The result has been, that much instructive information on the mechanism of the horse has been revealed, which is believed to be new, and of sufficient importance to be preserved and published."

We notice an interesting innovation introduced into the secondary schools at Wilna, Russia, namely, a popular medical course for the scholars of the higher class. Nearly all scholars have expressed the wish to follow these lectures, which contain general notions of hygiene and those necessary for giving medical assistance in simpler diseases, and the results obtained during the first year are said to be very satisfactory.

According to the *Mémorial Diplomatique*, the Congress of Electricians for determining the length of the column of mercury equivalent to the theoretical ohm, the advisability of establishing a system of tele-meteorology, and a system of observations for the electricity of the air, will meet on May 1 at Paris. Almost all the foreign governments, including the British, have appointed their delegates. The names of two only are wanting.

The Ethnological Museum of the Trocadero, Paris, has been inaugurated by a visit of the delegates of learned societies and a lecture by Dr. Hamy, one of the directors of the new establishment.

The meeting of the delegates of the learned societies of France took place at the Sorbonne on April 11, under the presidency of M. Leopold Delisle, member of the Institute belonging to the Commission of History, Archæology, and Philology. The Commission of Sciences was presided over by M. Milne-Edwards; M. Catalan was nominated president of the section of mathematics, M. Filhol of physico-chemical sciences, and M. Coteau of natural history. The sittings were not so numerous as in former years, and the communications were almost devoid of any real interest. The concluding sitting took place on April 15, M. Ferry, Minister of Public Instruction, being in the chair. He delivered a speech purporting to justify some changes in the general organisation of the Congress. They do not appear to have been beneficial to the institution, if it is possible to judge by the results of the present session, which has been the most barren of the whole series from 1863, when it was created by the government of Napoleon III., owing to the exertions of Leverrier.

The fourth general meeting of the delegates of the French departmental meteorological commissions met on April 13, under the presidency of M. J. Ferry, Minister of Public Instruction. The report on the working of the Central Bureau was presented by M. Hervé-Mangon, president of the Council of that institution. The Central Bureau receives daily ninety-seven telegrams from foreign parts, and fifty-two from France. These documents are utilised for drawing five maps in the morning and three in the evening, representing isobaric and isothermic curves, and variations of these elements from the preceding day, the force and direction of winds, rain, and storms. The warnings are sent by telegraph to eight agricultural regions and four maritime districts. The report states that these previsions were justified eighty-two times in one hundred. M. Hervé-Mangon proposes to extend the system of elegraphic connection to the Azores and Cape de Verde Islands in the south, United States in the west, and Ireland in the north. M. Hervé-Mangon reviewed the progress of high-level observatories. The observatory on the top of Pic du-Midi has just been fitted up at an altitude of 2877 metres, about twice the height of the Puy-de-Dome. General Nansouty's observations are wired every day, but this hardy observer and his followers having been blocked up by snow he was unable to attend the meeting. Before the end of the year a new mountain observatory will be completely established on Mount Aignal. The number of pluviometrical stations in the whole of France is 1561; the system is complete only in eighteen departments, in sixty-nine deficient, in ten *nil*. For the observation of thunderstorm phenomena forty-six departments send regular reports. Some details were also given on the expedition that France will send to the Antarctic regions. The station will be located somewhere on the islands situated to the south of Magellan Straits, very likely Orange Bay in Terra-del-Fuego, or Saint Martin Creek in Hermite Island.

We learn from the *Izvestia* of the Russian Geographical Society that N. W. Kaulbars, well known by his travels in Turkestan, has just published a very interesting work, "Notes on Montenegro," which contains under this modest title a very good description of that country. He knows the country from his own experience, having visited it three times as Russian commissioner, and having travelled throughout the Principality. The geographical and physical description of Montenegro is very complete.

Mr. C. Wolcott Brooks sends us an abstract of a paper which he read on March 21 at the Californian Academy of Sciences, giving the temperatures of the ground in the Forman shaft of the Comstock lode, at Virginia City, Nevada, taken by Charles Forman, superintendent, and forwarded by him for presentation to the Academy. They are taken from the surface to the depth of 2300 feet, as ascertained by drilling holes not less than 3 feet deep into the rock, and inserting into the hole a Negretti and Zambra slow acting thermometer, of the pattern adopted by the Underground Temperature Committee of the British Association, and standardised at Kew. These holes were closed with clay, and the thermometers were left in for twelve hours, not less than three holes being tried at each point. The following are the depths in feet, and temperatures in degrees Fahrenheit:—

Feet.	Deg.	Feet.	Deg.
100	50½	1300	91½
200	55	1400	96½
300	62	1500	101
400	60	1600	103
500	68	1700	104½
600	71½	1800	105½
700	74¾	1900	106
800	76¼	2000	111
900	78	2100	119½
1000	81½	2200	116
1100	84	2300	121
1200	89¼		

Messrs. Blackie and Sons have issued the second volume of the new edition of their "Imperial Dictionary," the first volume of which we noticed some time ago. It extends from *Dep* to *Kyt*, and is in all respects up to the standard of the previous volume.

MESSRS. JARROLD AND SONS have published a "Handbook to the Rivers and Broads of Norfolk and Suffolk," by Mr. G. Christopher Davies, who seems to be thoroughly acquainted with every winding and nook of these curious features of East Anglian scenery. It seems a really charming and easily accessible place for a quiet and refreshing holiday, gives ample scope for the collecting naturalist and the fisher who loves a well-filled basket.

FROM the *Report* of the Rugby School Natural History Society for 1881, we see that the work has been fairly sustained. The *Report* contains few papers by the members of the Society themselves, considerable space being given to an abstract of four instructive lectures on the Natural History of Islands, by Mr. A. R. Wallace. Appended to Mr. Seabroke's usual observatory report, is a Syllabus of work with the instruments in the Temple Observatory, which shows that very thorough instruction in practical astronomical work is available for the Rugby boys.

THE scarcity of water is excessive in France and Germany; the level of the Seine has never been so low since 1734. The quantity of rain which fell this winter has not reached half the usual quantity. The engineers of the City of Paris and the Government are trying to find protection against such a scarcity, which will turn to a calamity if rainy weather does not set in shortly.

IN February of last year an account was given in this journal of Baeyer's method for preparing artificial indigo (NATURE, vol. xxiii. p. 390). The fifth step in the process, as there described, consisted in the preparation of *orthonitrophenylpropiolic acid:* in a patent recently obtained by the "Badische Anilin und Soda-fabrik," bye-products obtained from this acid are employed as sources of indigo. By the action of alkaline-reducing agents, *e.g.* ammonium sulphide, on the ethyl salt of this acid, *ethylic indogenate* is obtained; thus, $C_8H_4 . NO_2(CO_2 . C_2H_5) + 2H_2 = C_8H_6NO(CO_2 . C_2H_5) + H_2O$. *Indogenic acid* (melting at 122° to 123°) is obtained by saponifying this ethylic salt; the acid easily gives off carbonic anhydride, either by boiling in aqueous solutions or by heating to its melting-point, with the production of *indogen*, C_8H_7NO, an oily liquid, showing yellow-green fluorescence. Any of these substances—ethylic indogenate, indogenic acid, or indogen—readily yields indigo blue by the action of dilute acids or alkalies, when freely exposed to the air, without heating.

THE recent study of the Rhone glacier by M. Gosset is probably the most detailed and exact that has ever been made of a glacier. According to Prof. Rutimeyer (who has recently written on the results of these researches) a precise topographical knowledge of the glacier is supplied; and the scale of representation (1 : 5000) allows of following all the details of form. There are also exact data as to the glacier's movements. Four rows of stones of different colours were placed, in 1874, on its surface, and their position has been precisely noted from time to time. These observations prove that the glacier advances much more rapidly in the upper part (600 to 680 m. since 1874) than near the extremity, where the progress has only been 150 m. below the cascade of ice; also that the ablation, *nil* in the higher parts, is very great in the lower; and that the difference in the progress of the central and the lateral parts of the glacier is much greater in the first part.

M. MONTIGNY published, a short time ago, some interesting observations on the effects of lightning on trees placed near a telegraph wire. A more extended examination of the road from Rochefort to Dinant has enabled him to mature his conclusions, and he now affirms (*Bull. Belg. Akad.*, 1) that "in the section of road beyond Rochefort, nine kilometres in extent, where one notices poplars that have been struck by lightning near a telegraph wire, the fulminant fluid has scarcely produced its effects, except in places where the provocative action of the wire is favoured by the influence exerted on it by a considerable group of lofty trees; this action is especially favoured in places where the road traverses woods on an elevation, but the differences of height seem to have less powerful influence than the surrounding and neighbourhood of wood." This conclusion agrees with what Arago observed as to the objects and places which lightning strikes by preference.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus*) from East Africa, presented by Mr. Robert Mills; a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. T. W. Gourlay; a Macaque Monkey (*Macacus cynomolgus* ♀) from India, presented by Mr. E. W. Hills; a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Capt. E. Jones; a Canada Goose (*Bernicla canadensis*) from North America, presented by Mr. George Edson; a Saker Falcon (*Falco sacer* ♂), captured in the Red Sea, presented by Mr. Battersby; a Chimpanzee (*Anthropopithecus troglodytes* ♀), an Angolan Vulture (*Gypohierax angolensis*), a Mueller's Parrakeet (*Tanygnathus muelleri*), a Ludio Monkey (*Cercopithecus ludio* ♂), a Blackish Sternothere (*Sternothærus subniger*) from West Africa, an Opossum (*Didelphys*, sp. inc.), a Kinkajou (*Cercoleptes caudivolvulus*), a Great-billed Rhea (*Rhea macrorhyncha*) from South America, four Meyer's Parrots (*Pæocephalus meyeri*) from East Africa, a Magellanic Goose (*Bernicla magellanica*) from Patagonia, a Brazilian Tree Porcupine (*Synetheres prehensilis*) from Brazil, a Western Black Cockatoo (*Calyptorhynchus naso* ♂) from Western Australia, two Indian River Snakes (*Tropidonotus quincunciatus*), an Indian Cobra (*Naia tripudians*) from India, purchased; a Crested Screamer (*Chauna chavaria*) from South America, received on approval; two Golden-headed Parrakeets (*Brotogerys tui*) from South America, received in exchange; three Chilian Pintails (*Dafila spinicauda*), hatched in the Gardens.

OUR ASTRONOMICAL COLUMN

COMET 1882 *a*.—Observations by Prof. Tacchini at the Observatory of the Collegio Romano, Rome, on April 6, gave the following place of this comet:—

	M.T. at Rome.		R.A.		Decl.
	h. m. s.		h. m. s.		° ′ ″
April 6 at	14 38 7	...	18 29 33·62	...	+44 54 34·9

From this position, which was kindly communicated by Prof. Tacchini, and those obtained at Harvard College, U.S., on March 19, and at Vienna on March 28, the following elements result:—

Perihelion passage 1882, June 9·96974 G.M.T.

	° ′ ″	
Longitude of perihelion	54 25 17·2	From Ap. Eq. April 0.
,, ascending node ...	204 37 42·1	
Inclination	73 35 39·4	
Log. perihelion distance	8·748238	

Motion—direct.

The co-ordinate constants to this parabola are (App. Eq. May 0):—

$$x = r\,[9{\cdot}96219] \sin (v + 127^\circ\ 10'{\cdot}3)$$
$$y = r\,[9{\cdot}86101] \sin (v + 61\ 33{\cdot}8)$$
$$z = r\,[9{\cdot}90055] \sin (v + 197\ 45{\cdot}4).$$

Hence with the X, Y, Z of the *Nautical Almanac* the following positions are found:—

At Greenwich midnight

		R.A.		Decl.		Log. distance from Earth.		Log. distance from Sun.
		h. m. s.		° ′				
April 20	...	19 15 41	...	+57 27·7	...	0·0528	...	0·1610
22	...	19 25 49	...	59 31·0	...	0·0414	...	0·1488
24	...	19 37 33	...	61 36·7	...	0·0303	...	0·1362
26	...	19 51 22	...	63 43·7	...	0·0196	...	0·1230
28	...	20 7 51	...	65 50·4	...	0·0093	...	0·1091
30	...	20 27 49	...	+67 54·8	...	9·9995	...	0·0946